

Hybridization Experiments in Rhodeine Fishes (Cyprinidae, Teleostei). An Intergeneric Hybrid between Female *Rhodeus ocellatus* and Male *Acanthorhodeus atremius*

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(Plate I)

IN an attempt to determine whether any genetic affinities still exist between rhodeine species, a number of interspecific and intergeneric crosses have been performed under laboratory conditions. This paper deals with results obtained by crossing *Rhodeus ocellatus* (Kner) with *Acanthorhodeus atremius* (Jordan & Thompson), both of Japanese origin.

One male *A. atremius* and four female *R. ocellatus* were placed in an aquarium, together with three South African freshwater mussels (*Aspatharia wahlbergi* Krauss). Although spawning behavior of these fishes differs slightly, spawning occurred. At short intervals fry were released by the mussels, and 15 arbitrarily selected larvae have been raised to the adult stage. A representative specimen of the adult hybrid form is illustrated in Plate I, Fig. 1.

All hybrids showed a male phenotype. In the breeding season they displayed full nuptial colors. Tubercles were abundantly present on the top of the snout. Spermatogenesis was normal. Their taxonomic characteristics will be described in a separate publication.

Four of these hybrids were allowed to breed freely with six females of the parental species, *R. ocellatus*, in the presence of six South African najads (*Aspatharia wahlbergi* Krauss and *Unio caffer* Krauss). Offspring were produced in the course of the following six weeks.

Twenty-five larvae, which had escaped from the mussels during one day, were placed in a separate aquarium and raised to the adult stage. Eighteen of them developed into functional females while the remaining seven specimens showed a male phenotype. The females developed a long ovipositor, and normal spawning be-

havior was observed. They were uniform in body size and shape and intermediate between both ancestral forms. A representative specimen is illustrated in Plate I, Fig. 2 (top). The males, however, were not uniform in size. The largest ones attained the body sizes of adult male *R. ocellatus* and the smallest ones those of adult male *A. atremius*. Representative specimens showing these extremes are illustrated in Plate I, Fig. 2. In all males, spermatogenesis was normal.

The above-mentioned back-cross generation was again allowed to interbreed freely, and another interfertile experimental population was obtained. Not full grown but sexually mature female and male specimens from it are illustrated in Plate I, Fig. 3. It is still too early to decide whether the characteristics of this population are similar to those of the ancestral stock or not.

The taxonomic significance of the present work will be discussed and forthcoming experimental populations will be reported in future publications.

SUMMARY

The successful intergeneric hybridization of female *Rhodeus ocellatus* and male *Acanthorhodeus atremius*, both of Japanese origin, is reported. All the hybrids were males. The offspring produced by crossing the hybrids back to the female parental species consisted of functional females and males. The females were uniform in body size and shape, and intermediate between both ancestral forms, but the males were not. The breeding of further generations from this back-cross stock is now in progress.

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ADDENDUM

Since the preparation of the manuscript, the following inter-specific and intergeneric hybrids have been reared to the adult stage:

FEMALE	MALE
Acheilognathus lanceolata	× Acanthorhodeus atremius
“ “	× Acheilognathus limbata (Japan)
“ “	× Acheilognathus rhombea
“ “	× Acheilognathus tabira
“ “	× Rhodeus ocellatus (Japan)
“ “	× Rhodeus ocellatus (Korea)
“ “	× Rhodeus spinalis
“ “	× Tanakia tanago
Acheilognathus rhombea	× Acheilognathus lanceolata
“ “	× Acheilognathus limbata (Japan)
“ “	× Acheilognathus tabira
“ “	× Rhodeus ocellatus (Japan)
“ “	× Rhodeus ocellatus (Korea)
“ “	× Rhodeus spinalis
“ “	× Tanakia tanago
Acheilognathus tabira	× Acheilognathus lanceolata
“ “	× Acheilognathus limbata (Japan)
“ “	× Rhodeus ocellatus (Japan)
“ “	× Rhodeus ocellatus (Korea)
“ “	× Tanakia tanago
Rhodeus ocellatus (Japan)	× Acanthorhodeus atremius
“ “ “	× Acheilognathus limbata (Japan)
“ “ “	× Rhodeus ocellatus (Korea)
“ “ “	× Rhodeus spinalis
Rhodeus ocellatus (Korea)	× Rhodeus ocellatus (Japan)
“ “ “	× Rhodeus spinalis
Rhodeus spinalis	× Acheilognathus lanceolata
“ “	× Acheilognathus limbata (Japan)
“ “	× Acheilognathus tabira
“ “	× Rhodeus ocellatus (Japan)
“ “	× Rhodeus ocellatus (Korea)
“ “	× Tanakia tanago
Tanakia tanago	× Acheilognathus lanceolata
“ “	× Acheilognathus limbata (Japan)
“ “	× Rhodeus ocellatus (Japan)
“ “	× Rhodeus ocellatus (Korea)

Ichthyologists who are interested in the description and publication of the taxonomic characteristics of these specimens, which are new to science, are invited to communicate with the author.

EXPLANATION OF THE PLATE

PLATE I

- FIG. 1. A representative adult intergeneric hybrid obtained by crossing *Rhodeus ocellatus* ♀ with *Acanthorhodeus atremius* ♂. Standard length 48 mm.
- FIG. 2. Three representative adult specimens of the back-cross generation (see text), one fe-

- male (top) and two males of the same age but of different size. Standard length: 38, 51 and 39 mm., respectively.
- FIG. 3. Two representative, not full grown but sexually mature, specimens of the “interbreeding population” (see text). Standard length of female (top) 25 mm., that of male 38 mm.